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ANALYSES OF SOME MAIN MACRO- AND MICROELEMENTS OF MEAT OF WILD BOARS WERE KEPT IN CAPTIVITY

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ABSTRACT
The aim of the study was the comparative evaluation of the chemical composition traits of wild boar meat from three different wild boar populations. The three populations were kept in three wild boar parks with different habitat conditions (Southern Great Plain and Southern and Middle Transdanubia Regions) with special regard to nutritional circumstances. Samples were collected from the *m. serratus anterior* of the animals. The following chemical parameters of the meat were examined: calcium, phosphorus, magnesium, iron, manganese, zinc, copper, iodine, selenium. We looked for relationship between habitat (especially the soil), the different traits of the animals, and the mineral content of the wild boar meat. It seems that samples from intensive nutritional circumstances and from animals provided with intensive supplementary feed contain more of the studied elements. The habitat and nutritional intensity made significant difference among the examined traits of the different wild boar groups.

Keywords: wild boar, habitat, meat, mineral content

INTRODUCTION

The consumption of game animals' meat in Hungary is very low. Hunters and their families eat game meat frequently, but most of the people do not buy it from the freezers of the supermarkets (GFK, 2003). The habits of consumers can be influenced with marketing as it was in the case of fish consumption in the last ten years. Unfortunately nowadays people choose food not on the nutritional value, but the price and the value of delight (colour, taste, etc.) have the greatest effect (KÁLLAI AND KRALOVÁNSZKY 1975; NAGY ET AL. 2008). Several studies on domesticated animals certified that the fodders consumed by the animals have an effect on the body composition and also on the quality (nutritive value, taste, technological quality) of the meat. Game meats are healthy foods and they are rich in minerals and vitamins, but poor in fats so they are suitable almost in every diet (LAMPÉRT, 2007).
The important minerals of game meats were studied by LUGASI (2006) e.g. iron, zinc, copper, manganese and selenium. The iron from meats can be absorbed in higher amount (15-30%) and more useful for the human body than from vegetal resources (RODLER, 2009). A well balanced nutrition can prevent iron deficiency. The daily zinc demand can be taken in with average meat consumption, and calculated with absorption of 20-40%. The zinc has an important role in several physiological processes. The minerals are responsible for several physical, chemical and physiological processes of the animals. The efficiency of the utilisation of minerals in the animals is higher if the sources are animals rather than plants.

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The aim of the study was the comparative evaluation of some chemical composition traits and technological properties of wild boar meat from three different wild boar populations. Macro and trace elements were chosen on their important role in wild boar/swine physiology, nutrition and meat quality (RÉGIUSNÉ MŐCSÉNYI, 2004; NRC 2005; MÉZES, 2007). The three populations were kept in three wild boar parks with different nutritional conditions.

MATERIAL AND METHOD

The aim of the study was the evaluation of the level of some minerals in wild boar meat. Samples (n=66) were collected in the period of November 2006 and March 2007 in 3 different wild boar park in different Hungarian counties (Csongrád, Fejér, Tolna). They differed from each other in the intensity of feeding and keeping technology: extensive in Fejér county, semi intensive in Csongrád county, intensive in Tolna county.
The intensity of feeding was determined by the supplementary feeding of the different parks: extensive – natural food resources of the habitat (reed, fish, snail, etc.) without supplementation; semi intensive – natural food resources of the habitat and supplementation with by-products of arable crop and horticultural production (carrot, potato, sugar beet, apple, water melon, paprika some cereals); intensive – natural food resources of the habitat and supplementation with concentrates.

Botanical characteristics of habitats:

- The location in Fejér county is reedy, featureless, secondary marshland which dries up intermittently. The spread of shrubs is indicated by some *Frangula alnus* plant. The *Deschampsia*, *Phragmites*, *Schoenoplectus*, *Calamagrostis* species create abundant vegetation. The incidence of the following weeds: *Solidago*, *Bidens*, *Cirsium* and *Lythrum* species are frequent.
- Pine sylviculture on dry, warm and sandy soil in Csongrád county. The *Pinus nigra* forest mixed with *Pinus silvestris* sporadically. The forest is closed in 50-60 % with deciduous trees (*Populus*, *Robinia*, *Ulmus*, *Amorpha*, *Ailanthus*, *Gleditschia*) on the edges and glades. The grass level plant composition is poor with the aggregation of invasive *Asclepias*.
- Plated oak forest in hilly area. The foliage cover of *Querqus cerris* in 15-18 m height is closed in 70-80 %. The shrub layer is consist of the seedlings of *Qerqus cerris*, *Ulmus* and *Carpinus*, and especially in the quadrates at the edges of the forest the immigrant *Crategus*, *Prunus*, *Ligustrum*, *Rosa* and *Pyrus* species. The grass layer is poor.

Sampling was done immediately after hunting and eviscerating. 500 g sample was collected from the *m. serratus anterior* of the animals (n=66). The samples were cooled on 4 °C for a duration period of 24 hours, and then they were deep-frozen. The samples were stored in freezer until processing. Soil samples were collected from all habitats by standard sampling method.
The levels of the following minerals were measured with ICP: calcium, phosphorus, magnesium, iron, manganese, zinc, copper, iodine and selenium. We looked for relationship between the feeding intensity of the animals and the mineral content of the wild boar muscle.
The analyses of variance and t-test were employed to test the statistical significance of the differences among the obtained means of the samples from the given population. Data obtained were submitted to statistical analysis by using SPSS 15.0 software package.

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RESULTS AND DISCUSSION

The iodine and manganese content was not significantly different in the meat of the wild boar groups what was fed with different intensity *(tab. 1).*

Table 1.

Mineral content of the wild boar meat from different feeding technology

	Extensive feeding (n=6) X ± SEM	Semi intensive feeding (n=30) X ± SEM	Intensive feeding (n=30) X ± SEM	Significance
Ca mg/kg	57.77±3.78a	189.3±38.35b	83.16±8.53c	P<0.05
P mg/kg	2501±51.19a	2009±66.43b	2500±81.23a	P<0.01
Mg mg/kg	250.8±4.99a	187.6±9.46b	259.7±8.85a	P<0.01
Mn mg/kg	0.220±0.038	0.569±0.119	0.517±0.052	Not sig.
Fe mg/kg	44.25±5.10ab	39.83±3.52a	55.66±3.83b	P<0.01
Cu mg/kg	1.922±0.169a	1.325±0.110b	2.174±0.092a	P<0.05
Zn mg/kg	52.17±6.99a	37.87±3.23b	50.28±3.62a	P<0.05
I mg/kg	0.071±0.008	0.107±0.019	0.111±0.009	Not sig.
Se mg/kg	0.130±0.013a	0.047±0.006b	0.075±0.005c	P<0.001

The calcium content was significantly different in the groups, lowest in the extensive and highest in the semi intensive group. The selenium level also differed in the 3 groups, but the value of this element was the lowest in the semi intensive group and the highest in the extensive group. The phosphorus, magnesium, copper and zinc content of the samples showed the following: the semi intensive group differed from the others, but there was no difference between the extensive and intensive groups. The iron content of the samples was significantly different in the semi intensive and intensive groups, but the extensive group did not differed from them. The sample size of the extensively fed group was too small, so this group was excluded from further statistical analyses.

The mineral content of the wild boar meat *(tab. 2, 3, 4)* from different gender did not differ significantly except iodine. In semi intensive feeding the meat of males contained higher level of selenium. Intensively fed males contained more iodine, but the females contained more zinc in their meat. It seems that the concentration of the studied elements is changing by the age *(tab. 5.)* of the animals, but it needs further examinations with a higher sample size.

Table 2.

Mineral content of the wild boar meat from different gender

Elements	Male (n=29) X ± SEM	Female (n=37) X ± SEM	Significance
Ca mg/kg	123.6±150,8	133.4±158.7	Not sig.
P mg/kg	2293.5±390.5	2264.3±509.0	Not sig.
Mg mg/kg	232.1±49.6	221.4±66.2	Not sig.
Mn mg/kg	0.47±0.48	0.54±0.58	Not sig.
Fe mg/kg	45.0±22.7	49.3±19.3	Not sig.
Cu mg/kg	1.64±0.58	1.85±0.73	Not sig.
Zn mg/kg	43.8±15.5	45.5±22.2	Not sig.
I mg/kg	0.13±0.10a	0.09±0.04b	P<0.005
Se mg/kg	0.07±0.03	0.06±0.03	Not sig.

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Table 3.

Mineral content of the semi intensively fed wild boars' meat by gender

Elements	Semi intensive feeding male (n=14) X ± SEM	Semi intensive feeding female (n=16) X ± SEM	Significance
Ca mg/kg	163.39±206.8	211.89±216.9	Not sig.
P mg/kg	2048.36±303.9	1974.62±416.1	Not sig.
Mg mg/kg	197.29±35.2	179.13±62.9	Not sig.
Mn mg/kg	0.40±0.34	0.72±0.82	Not sig.
Fe mg/kg	35.66±12.5	43.48±23.5	Not sig.
Cu mg/kg	1.24±0.36	1.39±0.76	Not sig.
Zn mg/kg	43.23±11.8	33.18±20.79	Not sig.
I mg/kg	0.13±0.13	0.08±0.05	Not sig.
Se mg/kg	0.06±0.03	0.03±0.02	P<0.1

Table 4.

Mineral content of the intensively fed wild boars' meat by gender

Elements	Intensive feeding male (n=10) X ± SEM	Intensive feeding female (n=20) X ± SEM	Significance
Ca mg/kg	99.98±60.0	74.75±37.4	Not sig.
P mg/kg	2539.0±388.5	2481.2±479.0	Not sig.
Mg mg/kg	272.5±44.0	253.2±50.4	Not sig.
Mn mg/kg	0.70±0.66	0.43±0.26	Not sig.
Fe mg/kg	59.14±30.7	53.92±14.72	Not sig.
Cu mg/kg	2.14±0.53	2.19±0.50	Not sig.
Zn mg/kg	39.99±17.98a	55.42±19.06b	P<0.05
I mg/kg	0.15±0.05a	0.09±0.03b	P<0.05
Se mg/kg	0.07±0.02	0.08±0.03	Not sig.

Table 5.

Mineral content of the wild boar meat from animals in different age

Elements	0 – 1 year old (n=4) X ± SEM	1 – 2 year old (n=21) X ± SEM	3 – 4 years old (n=32) X ± SEM	4 years – (n=9) X ± SEM	Significance
Ca mg/kg	99.4±49.2	184.5±195.0	77.2±44.2	200.4±254.2	Not sig.
P mg/kg	2487.7±250.2 ac	1972.3±374.4 b	2502.0±428.6 a	2094.7±343.1 bc	P<0.05
Mg mg/kg	261.0±16.1ac	178.4±56.3b	257.7±47.1a	209.1±32.7bc	P<0.05
Mn mg/kg	0.42±0.1	0.64±0.73	0.48±0.44	0.39±0.36	Not sig.
Fe mg/kg	37.3±9.3ab	39.9±21.4a	55.8±20.3b	39.5±13.9a	P<0.05
Cu mg/kg	2.06±0.23a	1.33±0.68b	2.16±0.51a	1.30±0.40b	P<0.05
Zn mg/kg	30.13±12.7ac	34.15±18.88ac	53.32±18.31b	46.54±10.98b c	P<0.05
I mg/kg	0.10±0.01	0.08±0.05	0.10±0.04	0.16±0.16	Not sig.
Se mg/kg	0.07±0.005ab	0.04±0.024a	0.08±0.036b	0.07±0.035b	P<0.05

The calcium level was the highest both in the meat and the soil of the semi-intensive group supposedly due to the high Ca-content (32.6 g/kg) of the mouldy sand soil. The phosphorus level was the lowest in the soil of the semi intensive habitat (376.mg/kg), and the highest (1167 mg/kg) in the extensive habitat. The vegetation of marshlands

contain Mn at low level (ANKE ET AL., 2005). Our result showed lower level of manganese in the extensive habitat's soil (143 mg/kg) than in the semi-intensive (314 mg/kg) or intensive (484.5 mg/kg) parks. The sand soil contained only the half of the magnesium of the other habitats' (extensive, intensive) soils (4.36 g/kg vs. 9.09 g/kg and 9.9 g/kg). The selenium content was the highest (2.62 mg/kg) in the loess soil of the intensive habitat and its hang together with the highest Se level of the meat from this environment. The pattern of iron content was similar in soil and meat samples (extensive: 7.7 g/kg vs. 44.25 mg/kg, semi-intensive: 4.33 g/kg vs. 39.83 mg/kg, intensive: 18.24 g/kg vs. 55.66 mg/kg).

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